Next Generation Robot Workshop 2005
Table of Identified Needs

August 23, 2005
Organized by the Robotic Industries Association (RIA) and the Manufacturing Engineering Laboratory of the National Institute of Standards and Technology (NIST)
NIST Campus
Gaithersburg, Maryland, USA

This was the organizational meeting to initiate a standards development effort to define the safety and performance requirements for the Next Generation Robot. The NGR is envisioned as a circa 2010 machine incorporating inherent safety design and benign operating features which enable and promote lean manufacturing. The meeting offered multiple stakeholders the opportunities to identify and target promising new technologies; establish requirements for interdisciplinary research efforts; and relationship building for the formal standardization effort. This meeting was an open brain-storming session with out-of-the-box thinking encouraged. Sponsored by the Robotic Industries Association, this meeting was hosted at the NIST facilities in Gaithersburg, Maryland. For more information contact Jeff Fryman at the RIA jfryman@robotics.org; (734) 994-6088.

Here is a thought-provoking list of subjects that was discussed:

1. Plant floor clothing, gloves and hats, which protect from injuries, without restricting mobility, dexterity and comfort.
Possible candidates are micro/nano technology composite garments, gloves and hats.
2. Embedded sensors which identify the presence and identity of machine operators.
These could be sensors embedded in human garments and/or robot skin, which constantly search for human presence and identity in the machine restricted area.
3. Impending injury warning systems.
Similar to sensors described in (2), which are now looking for close proximity to moving objects, high temperature or high voltage surfaces, etc.
4. Human vital signs monitoring systems.
Systems which will detect extreme biological state signs and then trigger alarms and provide the location and identity of the injured individual.
5. Safety sensing vision systems.
6. Force/motion sensing
7. Trajectory prediction/monitoring
8. Access permission
9. Force dynamics/limitations/testing
10. Servo motor/control development
11. Safety physiology
12. “Smart” materials/composite technologies
13. Tactile response
14. Scanning technologies
15. The regulatory environment

Table of Identified Needs Grouped Based on Priority Level:

	Next Generation Robot Needs Description	Standard	Research	Priority H=High M=Medium L=Low
1	Research that will enable to prove and certify the safety of NGR		X	H
2	Classify safe robots (validate safety claims)	X	X	H
3	NGR safety credibility for regulators, managers and labor unions	X	X	H
4	Easy lock out	X	X	H
5	Alternatives to E-Stop (varying speed, direction, proximity)	X	X	H
6	Intelligent robot response to safety emergencies (slow down, change path, notify)		X	H
7	Flexible servo drives	X	X	H
8	Position verification	X	X	H
9	Collision detection	X	X	H
10	NGR cost should be a consideration	X	X	H
11	Robot-human pain interface (current knowledge from IEEE and Japanese data)		X	H
12	Personal protective equipment (PTE) enabler		X	H
13	High performance which has a safety component	X	X	M
14	Improve control capability with safety in mind in an unstructured environment		X	M
15	High accuracy, cleanliness and variable foot print	X	X	M
16	Differentiate between humans and objects		X	M
17	Identify the presence, identity and the intentions of humans	X	X	M
18	Redundant sensors	X	X	M
19	Better cooperating mode (IAD)		X	M
20	Better slow speed control (validation) testing		X	M
21	NGR=A machine does all (Modular robots)		X	L
22	NGR manipulation at different scales		X	L
23	Easy robot-to robot interaction	X	X	L
24	Define the application and identify the problem	X	X	L

25	Safety networks based on software	X		
26	Standards should not impede competition at the international level	X		
27	Shift of liability to the robot manufacturer	X		
28	Crisp on scope of application	X		
29	Determine robot stop distance	X		
30	Reduce cost increase scope	X		
31	How do we get access to accident information?	X		
32	Use accident and near misses to guide NGR research	X		
33	Robot control adaptivity in order to reduce floor space	X		
34	Safety embedded programming	X		